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ABSTRACT

Using detailed cost breakdowns, this study attempts to determine the extent to which achievement of fourth- and eighth-grade students can be predicted from educational costs and school district size, and what combination of these variables and socioeconomic status best predicts student achievement (as measured by 1980-81 California Achievement Test scores in 152 school districts in a Southeastern state). Reported here with 15 tables are, first, a comparison of two canonical correlation models indicating the importance of socioeconomic status relative to cost and district size variables; and second, multiple regression analysis of the correlations of 10 predictor variables with test scores in each of 7 achievement areas at both grade levels. The findings indicate that costs of instruction are significantly related to student achievement. The authors conclude, however, that the cost of supporting a given level of achievement in low-income populations is quite high, and that mathematics concepts and applications scores are higher in large school districts due to greater teacher specialization in those districts. (MCG)

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THE RELATIONSHIP OF SCHOOL DISTRICT SIZE AND COST FACTORS TO ACHIEVEMENT OF FOURTH AND EIGHTH GRADE STUDENTS

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THE RELATIONSHIP OF SCHOOL DISTRICT SIZE AND COST FACTORS TO ACHIEVEMENT OF FOURTH AND EIGHTH GRADE STUDENTS

With the growing interest in educational accountability in an era of spiraling inflation, it is imperative that studies be conducted which can provide information about the relationship of various educational cost factors and school district size to academic achievement of students. Most such studies in the past used generic measures of educational costs; only rarely were more detailed breakdowns of the educational costs for instruction attempted. Today, many states provide cost data per pupil in average daily attendance on such cost factors as special programs, instructional media, instructional improvement, and guidance services; instructional costs for elementary and secondary education are also reported separately. This study sought to utilize the more detailed cost data in multivariate models which allowed the investigators to look at the total relationship of the variables in simultaneous interaction with each other.

Statement of the Problem

The problem in this study was to determine the relationship of school district size and educational cost factors to achievement of fourth and eighth grade students.

Questions to be answered were:

1. What percentage of overall variance in students' fourth and eighth grade achievement scores considered as composite variables could be predicted through the use of educational cost factors and

district size when the variance associated with percentage of students receiving free lunches was controlled?

2. What combination of district size and cost factors was the best predictor of students' achievement in the fourth and eighth grades when percentage of students receiving free lunches was considered as an interacting variable?

Procedures

The achievement measures used were scores on the California Achievement Tests in 152 school districts in a state in the Southeast. Cost and district size measures were available from official documents published by the department of education in that state. All measures included in the study were for the 1980-1981 school year.

To answer question one, two canonical correlation models were employed. A set of ten predictor variables was first correlated with fourteen separate measures of achievement for students at the fourth and eighth grade levels. The predictor set was comprised of costs of regular elementary instruction, regular secondary instruction, special programs, guidance services, media services, instructional improvement, support services, district size, assessment, and percentage of students receiving free lunches. Achievement measures serving as dependent variables were reading vocabulary, reading comprehension, spelling, language mechanics, language expression, mathematics computations, and mathematics concepts and applications as measured by the California Achievement Tests. The second canonical model was indentical to the first except that the variable

of free lunches was not included in the predictor set.

Multiple regression analysis was used in question two.

Definition of Terms

The following definitions of variables used in the predictor set are given to aid in an understanding of what is included in each expenditure category.

Special Programs - Instructional activities designed primarily to deal with pupils having special needs. The Special Program Service Area includes services for the gifted and talented, mentally retarded, physically handicapped, emotionally disturbed, culturally different, pupils with learning disabilities, and special programs for other types of pupils.

Regular Instructional Programs - Instructional activities designed primarily to prepare pupils for activities as citizens, family members, and workers, as contrasted with program designed to improve, or overcome physical, mental, social and/or emotional handicaps.

Guidance Services - Those activities of counseling pupils and parents, providing consultation with other staff members on learning problems, assisting pupils in personal and social development, assessing the abilities of pupils, assisting pupils as they make their own educational and career plans and choices, providing referral assistance, and working with other staff members in planning and conducting guidance programs for pupils.

Improvement of Instruction Services - Those activities which are designed primarily for assisting instructional staff in planning, developing, and

evaluating the process of providing learning experiences for pupils. These activities include curriculum development, techniques of instruction, child development and understanding, and staff training.

Educational Media Services - Activities concerned with the use of all teaching and learning resources, including hardware, and content materials. Educational media are defined as any device, content material, method, or experience used for teaching and learning purposes. These include printed and non-printed sensory materials.

Support Services - Central -- Activities, other than general administration, which support each of the other instructional and supporting services programs. These activities include planning, research, development, evaluation, information, staff, statistical, and data processing services.

Findings

The results obtained when the two canonical correlation models were employed are reported in Table 1.

Table 1

Amount of Variance in Fourth and Eighth Grade CAT Scores Predicted by Use of Cost Factors, School District Size, and Percent of Students Receiving Free Lunches Through Canonical Correlation Models

Model	Canonical Correlation	R^2	DF	Chi-Square
Model I: Cost Factors, District Size, and Percent of Free Lunches	.81	.656	140	290.33*
Model II: Cost Factors and District Size	.71	.504	126	218.72*

* Significant at .01 level.

Canonical Model I yielded a correlation of .81 in the one canonical root found to be significant at the .05 level. It was determined that 65.6% of the variance in achievement scores could be accounted for through the use of cost factors, district size, and economic level as inferred through the percentage of students receiving free lunches.

Canonical Model II was indentical to the first except that the variable of free lunches was not included in the predictor set. Cost and school district size factors as a whole correlated .71 with the set of achievement variables; 50.4% of the variance in students' achievement could be accounted for through the use of program costs and district size variables alone.

The results of the multiple regression analysis are presented in Tables 2-15. Each table is a summary table depicting the significant predictor variables for a particular dependent achievement variable.

Table 2

Multiple Regression Analysis of Significant Predictor Variables and the Dependent Variable of Fourth Grade Reading Vocabulary Scores

Predictor Variable	Multiple R	R Square	RSq. Change	Simple R
Free Lunches	.61	.37	.37	-.61
Special Programs	.66	.43	.06	-.50
Media Services	.69	.48	.05	-.26
Reg. Instrn. - Total	.70	.50	.02	.07
Instrn. Improvement	.72	.52	.02	-.36
Support Services	.72	.53	.01	-.37
District Size	.73	.53	.01	-.08

Table 3

Multiple Regression Analysis of Significant Predictor Variables and the Dependent Variable of Fourth Grade Reading Comprehension Scores

Predictor Variable	Multiple R	R Square	R Square Change	Simple R
Free Lunches	.64	.41	.41	-.64
Instrn. Improvement	.70	.49	.08	-.42
Special Programs	.72	.52	.03	-.52
Media Services	.73	.54	.02	-.21
Reg. Instrn. - Total	.75	.56	.02	.05

Table 4

Multiple Regression Analysis of Significant Predictor Variables and the Dependent Variable of Fourth Grade Spelling Scores

Predictor Variable	Multiple R	R Square	R Square Change	Simple R
Free Lunches	.36	.13	.13	-.36
Media Services	.40	.16	.03	-.19
District Size	.41	.17	.01	.05
Reg. Instrn. - Total	.42	.18	.01	.04

Table 5

Multiple Regression Analysis of Significant Predictor Variables and the Dependent Variable of Fourth Grade Language Expression Scores

Predictor Variable	Multiple R	R Square	R Square Change	Simple R
Free Lunches	.58	.34	.34	-.58
Special Programs	.66	.44	.10	-.54
Instrn. Improvement	.69	.48	.04	-.42
Media Services	.71	.50	.02	-.23
Reg. Instrn. - Total	.72	.53	.03	.07

Table 6

Multiple Regression Analysis of Significant Predictor Variables and the Dependent Variable of Fourth Grade Language Mechanics Scores

Predictor Variable	Multiple R	R Square	R Square Change	Simple R
Free Lunches	.47	.22	.22	-.47
Special Programs	.54	.29	.07	-.44
Instrn. Improvement	.57	.32	.03	-.37
Media Services	.58	.34	.02	-.21
District Size	.59	.35	.01	-.04

Table 7

Multiple Regression Analysis of Significant Predictor Variables and the Dependent Variable of Fourth Grade Mathematics Computation Scores

Predictor Variable	Multiple R	R Square	R Square Change	Simple R
Free Lunches	.47	.22	.22	-.47
Instrn. Improvement	.54	.29	.07	-.38
Special Programs	.57	.32	.03	-.43
Media Services	.59	.34	.02	.07
Support Services	.60	.37	.03	-.21
District Size	.62	.38	.01	-.35

Table 8

Multiple Regression Analysis of Significant Predictor Variables and the Dependent Variable of Fourth Grade Mathematics Concepts and Applications Scores

Predictor Variable	Multiple R	R Square	R Square Change	Simple R
Instrn. Improvement	.32	.10	.10	-.32
Free Lunches	.40	.16	.06	-.31
District Size	.44	.19	.03	.08
Support Services	.48	.23	.04	-.30
Reg. Instrn. - Total	.50	.25	.02	.02

Table 9

Multiple Regression Analysis of Significant Predictor Variables and the Dependent Variable of Eighth Grade Reading Vocabulary Scores

Predictor Variable	Multiple R	R Square	R Square Change	Simple R
Free Lunches	.57	.32	.32	-.57
Instr. Improvement	.60	.36	.04	-.34
Media Services	.61	.38	.02	-.18
Reg. Instrn. - Total	.63	.40	.02	.04

Table 10

Multiple Regression Analysis of Significant Predictor Variables and the Dependent Variable of Eighth Grade Reading Comprehension Scores

Predictor Variable	Multiple R	R Square	R Square Change	Simple R
Free Lunches	.55	.31	.31	-.55
Instr. Improvement	.61	.38	.07	-.40
Reg. Instrn. - Total	.63	.40	.02	.06

Table 11

Multiple Regression Analysis of Significant Predictor Variables and the Dependent Variable of Eighth Grade Spelling Scores

Predictor Variable	Multiple R	R Square	R Square Change	Simple R
Free Lunches	.31	.10	.10	-.31
Instrn. Improvement	.34	.11	.01	-.20

Table 12

Multiple Regression Analysis of Significant Predictor Variables and the Dependent Variable of Eighth Grade Language Expression Scores

Predictor Variable	Multiple R	R Square	R Square Change	Simple R
Free Lunches	.47	.22	.22	-.47
Instrn. Improvement	.55	.30	.08	-.38

Table 13

Multiple Regression Analysis of Significant Predictor Variables and the Dependent Variable of Eighth Grade Language Mechanics Scores

Predictor Variable	Multiple R	R Square	R Square Change	Simple R
Free Lunches	.45	.20	.20	-.45
Instrn. Improvement	.53	.28	.08	-.37
Reg. Instrn. - Secondary	.55	.30	.02	.13
Special Programs	.56	.31	.01	-.39
Media Services	.57	.33	.02	-.19

Table 14

Multiple Regression Analysis of Significant Predictor Variables and the Dependent Variable of Eighth Grade Mathematics Computation Scores

Predictor Variable	Multiple R	R Square	R Square Change	Simple R
Free Lunches	.33	.11	.11	-.33
Instrn. Improvement	.37	.14	.03	-.24
Support Services	.39	.15	.01	-.25
Reg. Instrn. - Total	.41	.17	.02	.05
District Size	.43	.18	.01	-.01

Table 15

Multiple Regression Analysis of Significant Predictor Variables and the Dependent Variable of Eighth Grade Mathematics Concepts and Application Scores

Predictor Variable	Multiple R	R Square	R Square Change	Simple R
Free Lunches	.44	.19	.19	-.44
Instrn. Improvement	.49	.24	.05	-.32
Reg. Instrn. - Total	.51	.26	.02	.07
Support Services	.53	.28	.02	-.27
Guidance Services	.54	.29	.01	-.10

The percent of students receiving free lunches was negatively related to achievement scores in all areas tested at both the fourth and eighth grade levels. In all instances except one the free lunch variable accounted for the major portion of the variance among school districts on achievement test scores.

The amount of money spent per pupil in average daily attendance for instructional improvement was negatively related to achievement scores in six of the seven areas tested in the fourth grade with spelling scores being the sole exception. The instructional improvement expenditure variable was negatively related to all seven areas tested in the eighth grade.

The amount of money spent per pupil for educational media services was negatively related to achievement scores on six of the seven areas tested at the fourth grade level with mathematics concepts and applications scores providing the exception. The media services expenditure was related to only two subject area variables at the eighth grade levels -- reading vocabulary scores and language mechanics scores; the obtained measure of the relationship was negative in both instances.

The amount of money spent per pupil for special programs was negatively related to achievement scores on five of the seven areas tested at the fourth grade level, with spelling scores and mathematics concepts and applications scores being the exceptions. Special programs expenditures were related to just one of the areas tested at the eighth grade level; a negative relationship was obtained between special program expenditures and language mechanics scores.

The amount of money spent per pupil for support services was negatively related to reading vocabulary scores, mathematics computation scores, and

mathematics concepts and application scores at the fourth grade level and to the two mathematics areas at the eighth grade level.

There was a positive relationship between the total amount of money spent per pupil for regular classroom instruction and reading vocabulary scores, reading comprehension scores, spelling scores, language expression scores, and mathematics concepts and applications scores at the fourth grade level. Expenditures for regular classroom instruction were positively related to reading vocabulary scores, reading comprehension scores, mathematics computation scores, and mathematics concepts and application scores at the eighth grade level.

School district size was negatively related to fourth grade achievement scores in reading vocabulary, language mechanics, and mathematics computation. District size was positively related to fourth grade scores in spelling and mathematics concepts and applications. The size variable was related to only one eighth grade achievement area; a negative relationship was obtained between district size and mathematics computation scores.

The predictor variables of assessment per pupil and per pupil expenditures for regular instruction at the elementary level were not significant predictors of achievement scores in any subject area at either the fourth or eighth grade levels. Per pupil expenditures for regular secondary instruction was a significant predictor in only one subject area, eighth grade language mechanics scores, where a positive relationship was obtained.

Discussion

As expected, there was a significant relationship between costs for instruction and student achievement. A major finding of this study appears to be that instructional costs for special programs, educational media and

instructional improvement were negatively correlated with student achievement. This finding seems to indicate that it costs much more to support the same level of achievement in schools which serve a low socioeconomic level population.

District size correlated negatively with achievement in mathematics computation, language mechanics and vocabulary at the fourth grade level while it related positively to mathematics concepts and application scores. Perhaps more large school systems have mathematics taught in a departmentalized organizational structure, while smaller school districts may have mathematics taught in a self-contained classroom setting by someone with a less specific math background in concepts and problem solving. In contrast, the generalist teachers may promote more learning in language and vocabulary since they teach reading in the total context of the instructional program.